

***Carex foliosissima* var. *pallidivaginata* (Cyperaceae), a new variety from Japan**

JIRO ODA¹ and HIDETOSHI NAGAMASU²

¹Osaka Prefectural Kashiwara Higashi High School, Kashiwara-shi, Osaka 582-0015, Japan, ²The Kyoto University Museum, Kyoto 606-8501, Japan

A new variety, *Carex foliosissima* F. Schmidt var. *pallidivaginata* J. Oda & Nagam., is newly described. It is distinguished from the type variety by the pale green basal sheaths, turning light brown on drying, and perigynia with invisible or inconspicuous veins. It is also distinct in the leaf anatomy; the leaves of the new variety are thinner and the second layer of bulliform cells (hinge cells) is thinner than that of var. *foliosissima*. Variety *pallidivaginata* is distributed from the upper beech forest zone to the subalpine zone on the Japan Sea side of central and northern Honshu, and in southernmost Hokkaido, at higher elevations than var. *foliosissima* which usually occurs from the lowland to lower montane zones. Variation in the leaf width of *C. foliosissima* was examined and the results did not support the wide leaved form ('var. *latissima*' Akiyama) as a distinct variety.

Key words: *Carex foliosissima*, *Carex foliosissima* var. *pallidivaginata*, Japan, leaf anatomy

Carex foliosissima F. Schmidt is distributed from Sakhalin, south to northern Kyushu, Japan. This species is a member of sect. *Praecoces* Christ., a group that is very diverse in eastern Asia, and is further classified in subsect. *Foliosissimae* Akiyama together with other six species, *C. morrowii*, *C. conica*, *C. oshimensis*, *C. okushirensis*, *C. daibuen-sis*, and *C. temnolepis* (Akiyama 1955). Species belonging to subsect. *Foliosissimae* are characterized by the dark colored basal sheaths, remote spikes, sheathed bracts, perigynia with many veins and achenes with apical bands (Akiyama 1955). *Carex foliosissima* is distinguished from other members by its stoloniferous rhizomes and having pistillate scales longer than the perigynia, and is known as a very variable species (Koidzumi 1930, Akiyama

1955). Variety *latissima* was recognized as an infraspecific taxon of *C. foliosissima* by Akiyama (1955), Ohwi (1953), and Ohwi & Kitagawa (1992), while Koyama (1962, 1964) and Okamoto (1965) did not recognize any infraspecific taxa in *C. foliosissima*.

Recently, one of the authors, Oda, found a sedge at Mt. Iburi-yama, Toyama Pref., in central Honshu which is similar to *C. foliosissima* in having stoloniferous rhizomes, 4-5 remote spikes, clavate staminate spike, cylindrical pistillate spikes with sheathed bract and pistillate scales longer than perigynia, but it is different in having pale green basal sheaths and perigynia without distinct veins. Here we describe this plant as a new variety, *C. foliosissima* var. *pallidivaginata*.

¹Present address, Osaka prefectural Fujiidera High School, Fujiidera-shi, Osaka 583-0037, Japan

Materials and Methods

A total of 311 specimens (19 and 292 specimens for var. *pallidivaginata* and var. *foliosissima*, respectively) deposited in the following herbaria were examined: Kanazawa University, Kanazawa (KANA), Kyoto University, Kyoto (KYO), Osaka Museum of Natural History, Osaka (OSA), Muséum National Histoire Naturelle, Paris (P), Hokkaido University, Sapporo (SAPS), Tohoku University, Sendai (TUS), and Yamagata Prefectural Museum, Yamagata (YMG). Acronyms for herbaria follow Holmgren *et al.* (1990) except Yamagata Prefectural Museum.

Leaf width was measured at the widest point of the widest leaf of each specimen that we examined for this study.

For leaf anatomy, the widest mature leaf in each specimen was used. For var. *pallidivaginata*, all examined specimens were used except for the type material (Faurie 3985). For var. *foliosissima* we selected 15 specimens considering geographical distribution and the variance of leaf width (Table 1). The samples 3cm long were placed in a test tube and heated in a water bath at 60°C for 2 hs. Sections were made with a thin razor blade and mounted in 30 % calcium chloride, with a cover glass. Leaf thickness was measured at the middle point between the midrib and adjacent lateral rib under a light microscope. Thickness of bulliform cell layers was measured at the middle of the midrib from microphotographs.

Results and Discussion

Color of basal sheaths

The color of basal sheaths has often been regarded as an important taxonomic character for recognizing species or varieties in the genus *Carex* (e.g. Koyama 1961). The basal sheaths of var. *pallidivaginata* and var. *foliosissima* are shown in Fig. 2. The basal sheaths of var. *pallidivaginata* are pale green, turning light brown when dry. The connate part of basal

sheath is hyaline and the inner sheath can be seen from outside (Fig. 2A). In var. *foliosissima*, the basal sheaths are purplish brown to blood-reddish brown, and the inner sheaths cannot be seen from outside (Fig. 2B). The specimens collected from Sakhalin and the northern Hokkaido often show rather light colored basal sheaths (Table 1), but the inner sheaths cannot be seen from outside. The color of basal sheaths, pale green turning light brown when dry, is the most important character for identification of this variety.

Veins of perigynia

Presence or absence of distinct veins on the perigynia is a significant character of taxonomy of genus *Carex* (e.g. Egorova 1999). The veins on the perigynia of var. *foliosissima* are usually 12-18 in number and clearly visible. In most cases, those of var. *pallidivaginata* are invisible or inconspicuous except for the two large suture veins (Fig. 1 K & L), although there are some exceptions as in *Y. Yuki s.n.* or *Y. Yuki 14263* collected from Mt. Gassan, Yamagata Prefecture. In these specimens, 5-11 veins are clearly visible. However these specimens have light brown basal sheaths, a rather thin leaf blade and a second layer of bulliform cells, so we regard them as *C. foliosissima* var. *pallidivaginata* (Table 1).

Leaf anatomy

The results of the measurement of leaf thickness are given in Table 1. The mean leaf thickness of var. *pallidivaginata* and *foliosissima* was 202µm (N = 18, range 155-280µm, SD = 34) and 318µm (N = 15, range 250-420µm, SD = 48), respectively. Variety *pallidivaginata* has thinner leaves than those var. *foliosissima* (*t*-test, $P < 10^{-8}$). This seems to be the reason the leaf color of the former is lighter than the latter.

Akiyama studied the leaf anatomy of many *Carex* species with special reference to bulliform cells (as 'hinge cells'), arranged along the midrib (e.g. Akiyama 1933a, b, c, & d). He described the

bulliform cells of *C. foliosissima* as composed of two layers, with cells of the first layer under 40µm thick and the second layer ca. 70µm thick (Akiyama 1933c).

The results of our observation are given in Table 1 and transections of leaves of both varieties are shown in Fig. 3. The bulliform cells were composed of 2 or 3 layers, and the third layer was observed only in 3 of 15 samples of var. *foliosissima*. The first layer was not significantly different in thickness between the two varieties, in the range of 25-40(-50)µm (*t*-test, *P* = 0.53). The thickness of the second layer was very variable, and the measurements for var. *pallidivaginata* and var. *foliosissima* were 30-70µm (Mean = 39, SD = 11) and 50-150µm (Mean = 81, SD = 28), respectively. The former has thinner second layer than the latter (*t*-test, *P* < 10⁻⁵). The thickness of the second layer of bulliform cells seems to be related to leaf thickness.

Variation in leaf width

Carex foliosissima has been known as a very variable species (Koidzumi 1930, Akiyama 1955). A form with leaves ranging 15-20 mm wide has often been treated as a distinct variety, var. *crassicaulis* (Kük.) Akiyama or var. *latissima* (Ohwi) Akiyama (Akiyama 1932). To evaluate the taxonomic significance of leaf width in *C. foliosissima*, we examined variation of leaf width based on 311 herbarium specimens.

The distribution of leaf width is shown in Fig. 4. The leaf width of *C. foliosissima* excluding var. *pallidivaginata* ranged from 3.5 to 22.0 mm, and the mean was 8.5 mm (*N* = 292). The distribution shows one distinct peak at the 6 mm width. This result shows that it is impossible to recognize any infraspecific taxon delimited only by leaf width. The measurements of var. *pallidivaginata* ranged from 6 to 11.6 mm, the mean was 8.5 mm (*N* = 19), and were included in the range of *C. foliosissima* excluding var. *pallidivaginata*.

Habitat and distribution

A distribution map of var. *pallidivaginata* is shown in Fig. 5. The new variety is restricted to higher elevations (1050-2200m) of the Japan Sea side of central and northern Honshu, from the upper beech forest zone to the subalpine zone, and at lower elevations in Hokkaido. Esan population is represented by a single specimen, *U. Faurie* 3985 (KYO), which is a duplicate specimen of the type of *Carex yesanensis* Franch. The holotype in Muséum National d'Histoire Naturelle, Paris (P) has dark basal sheaths which are the characteristic of var. *foliosissima*. We made a field survey to examine the plants growing at Cape Esan, in June 2002, but could not find either variety.

Variety *foliosissima* has a wider distribution range from southern Sakhalin to northern Kyushu, ranging from 30 m (Soya, Hokkaido) to 1600 m (Tateshina, Nagano) in altitude. It seems to grow at lower elevations than var. *pallidivaginata*. At Mt. Iburiyama, Toyama Pref. (type locality), var. *pallidivaginata* occurs from 1600 to 1800 m in altitude, while var. *foliosissima* from the foot of mountain to 1200 m.

Conclusion

Here we treat *Carex foliosissima* as a species composed of two varieties, var. *foliosissima* and var. *pallidivaginata*.

Taxonomic treatment

Carex foliosissima F. Schmidt, Reis. Amurl. Ins. Sachal.: 195, t.6, f. 1-6 (1868).

Rhizomes loosely tufted, stoloniferous. *Culms* 15-40 cm high, trigonous, smooth, basal sheaths pale green or purplish brown to blood reddish brown. *Leaves* taller than or as long as culms, plane, 2-ribbed on adaxial surface or not, light green or dark green, 3.5-22 mm wide, bulliform cells are composed of 2(-3) layers. *Spikes* 4-5, remote, erect,

TABLE 1. Color of basal sheaths, veins of perigynia and leaf anatomy of two varieties in *Carex foliosissima*

<i>C. foliosissima</i>	Locality (date)	Collector and no. (herb.)	Color of basal sheaths
var. <i>pallidivaginata</i>	Gassan, Yamagata (Aug. 1932)	<i>Y. Yuki s.n.</i> (KYO)	light brown
	Gassan, Yamagata (11 Aug. 1977)	<i>Y. Yuki 14263</i> (YMG)	light brown
	Hayama, Yamagata (15 Jun. 1972)	<i>N. Kato s.n.</i> (YMG)	light brown
	Makihatayama, Niigata (26 Jun. 1980)	<i>H. Kariya 4551</i> (KYO)	light brown
	Makihatayama, Niigata (9 Aug. 1980)	<i>H. Kariya 5515</i> (KYO)	light brown
	Okenashiyama, Niigata (3 Jul. 1958)	<i>J. Yoshikawa 3917</i> (TUS)	light brown
	Korengenyama, Niigata (3 Aug. 1951)	<i>S. Iwano 7015</i> (TUS)	light brown
	Udogawa'Renge, Niigata (1 Aug. 1959)	<i>S. Takahashi s.n.</i> (TUS)	light brown
	Amakazariyama, Nagano (26 Jul. 1979)	<i>K. Seto 25748</i> (OSA)	light brown
	Hakuba-tsugaike, Nagano (30 Jul. 1935)	<i>J. Ohwi 7707</i> (KYO)	light brown
	Hakuba-tengu, Nagano (3 Aug. 1951)	<i>Y. Okamura 1138</i> (TUS)	light brown
	Iburiyama, Toyama (23 Jul. 2000)	<i>J. Oda 949</i> (KYO)	light brown
	West Hakuba, Toyama (30 Jul. 1935)	<i>J. Ohwi 7805</i> (KYO)	light brown
	Tateyama, Toyama (30 Aug. 1929)	<i>Z. Tashiro s.n.</i> (KYO)	light brown
	Tateyama-onsen, Toyama (31 Aug. 1929)	<i>Z. Tashiro s.n.</i> (KYO)	light brown
	Hayatsuki-one, Toyama (30 Jul. 2000)	<i>M. Ichikawa s.n.</i> (KYO)	light brown
	Dainichidake, Toyama (13 Aug. 1974)	<i>M. Mikage 5581</i> (OSA)	light brown
var. <i>foliosissima</i>	Korsakof, Sakhalin (Jul. 1908)	<i>U. Faurie 896</i> (KYO)	light purplish brown
	Kamikawa, Hokkaido (11 Jun. 1978)	<i>G. Murata 37451</i> (KYO)	blood reddish brown
	Daito-dake, Miyagi (3 May 1960)	<i>H. Ohashi & T. Kaneko s.n.</i> (TUS)	dark purplish brown
	Suzugamori, Miyagi (27 May 1981)	<i>H. Ohashi et al. s.n.</i> (TUS)	dark purplish brown
	Shimodamura, Niigata (19 May 1984)	<i>G. Murata 45101</i> (KYO)	dark purplish brown
	Yahikosan, Niigata (14 Jun. 2000)	<i>J. Oda 873</i> (KYO)	blood reddish brown
	Ishikawa-gun, Ishikawa (27 Apr. 1987)	<i>S. Tsugartu 7944</i> (KYO)	dark purplish brown
	Kyoto-shi, Kyoto (27 May 2000)	<i>J. Oda 837</i> (KYO)	dark purplish brown
	Kyoto-shi, Kyoto (16 May 1998)	<i>G. Murata 26236</i> (KYO)	purplish brown
	Hyonosen, Hyogo (19 May 1980)	<i>Tak. Shimizu 80135</i> (KYO)	purplish brown
	Wasamata-yama, Nara (20 May 1987)	<i>S. Tsugaru 7913</i> (KYO)	purplish brown
	Oki, Shimane (20 Apr. 1979)	<i>N. Kurosaki 9987</i> (KYO)	dark purplish brown
	Umagun, Ehime (8 Jun. 2000)	<i>O. Tokui 4153</i> (KYO)	purplish brown
	Seburiyama, Fukuoka (5 May 1978)	<i>S. Tsutsui 15578</i> (KYO)	dark purplish brown
	Kawachi-keikoku, Fukuoka (10 May 1978)	<i>S. Tsutsui 13628</i> (KYO)	purplish brown

peduncles exserted; terminal spike staminate, linear to clavate, 15-35 mm long; lateral spikes pistillate, cylindrical, 20-40 mm long. *Bracts* long and loosely sheathed with short blade. *Pistillate scales* ovate, pale green or light brown or partly reddish brown,

2.5-4.5 mm long, acute or mucronate at apex, dorsal part green, 3-nerved. *Staminate scales* narrowly obovate, light brown to dark brown, 7-10 mm long, ciliate and mucronate at apex. *Perigynia* shorter than pistillate scales, horizontally patent later, with

TABLE 1 (continued)

Veins of perigynia	Bulliform cells			Leaf		
	Number of layers	Thickness of layer (μm)			Thickness (μm)	Width (mm)
		1st layer	2nd layer	3rd layer		
distinct	2	35	35		200	9.8
distinct	2	40	40		200	10.0
inconspicuous	2	40	50		240	11.6
inconspicuous	2	40	40		280	7.2
inconspicuous	2	40	30		200	8.1
inconspicuous	2	25	30		200	10.4
invisible	2	40	60		180	7.4
invisible	2	25	70		250	9.6
inconspicuous	2	35	35		220	9.2
inconspicuous	2	35	40		230	7.9
invisible	2	40	35		170	9.6
invisible	2	35	30		190	10.5
invisible	2	40	30		230	8.9
invisible	2	40	30		170	6.8
invisible	2	40	35		160	6.0
invisible	2	40	40		180	7.4
inconspicuous	2	30	40		180	8.2
	Mean	36	39		205	8.7
distinct	2	30	50		280	11.6
distinct	2	30	80		300	6.5
distinct	3	20	80	30	300	5.3
distinct	2	30	80		320	4.8
distinct	2	30	80		420	6.1
distinct	2	25	60		330	5.6
distinct	2	50	50		250	7.2
distinct	2	40	80		250	6.4
distinct	2	40	120		310	14.0
distinct	2	40	150		350	17.0
distinct	2	40	100		300	14.0
distinct	3	40	50	30	380	6.8
inconspicuous	2	50	100		380	13.0
distinct	2	35	70		350	7.0
distinct	3	30	60	30	320	14.0
	Mean	35	81		323	9.3

a very short stipe, obovoid, membranaceous, and pale yellowish green to yellowish green, 2.5-3.5 mm long, trigonous, glabrous, veins invisible or inconspicuous or distinct, apex abruptly contracted

in rostrum, shortly bidentate. *Achenes* tightly wrapped by perigynia, obovoid, obtusely trigonous, 1.5-2.0 mm long, apical disk not developed, base of styles moderately thickened. Stigmas 3.

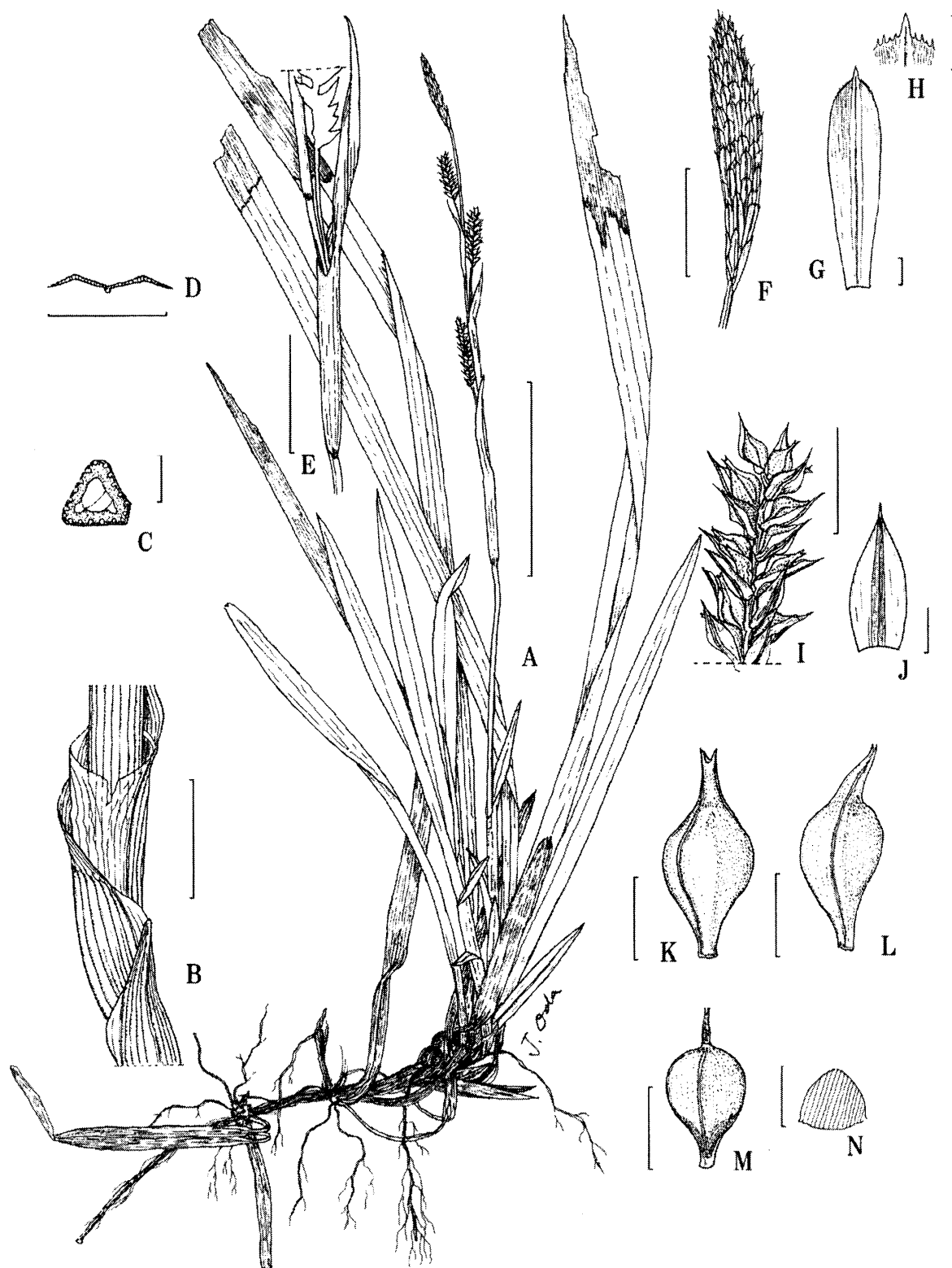


FIG. 1. *Carex foliosissima* F. Schmidt var. *pallidivaginata* J. Oda & Nagam. (J. Oda 949). A: habit; B: basal sheath; C: transection of culm; D: transection of leaf blade; E: bract; F: staminate spike; G: staminate scale; H: apex of staminate scale; I: pistillate spike; J: pistillate scale; K: perigynium (dorsal view); L: perigynium (lateral view); M: achene; N: transection of achene. Bar = 5 cm for A; 1 cm for B, D, E, F, I; 1 mm for C, G, H, J, K, L, M, N.

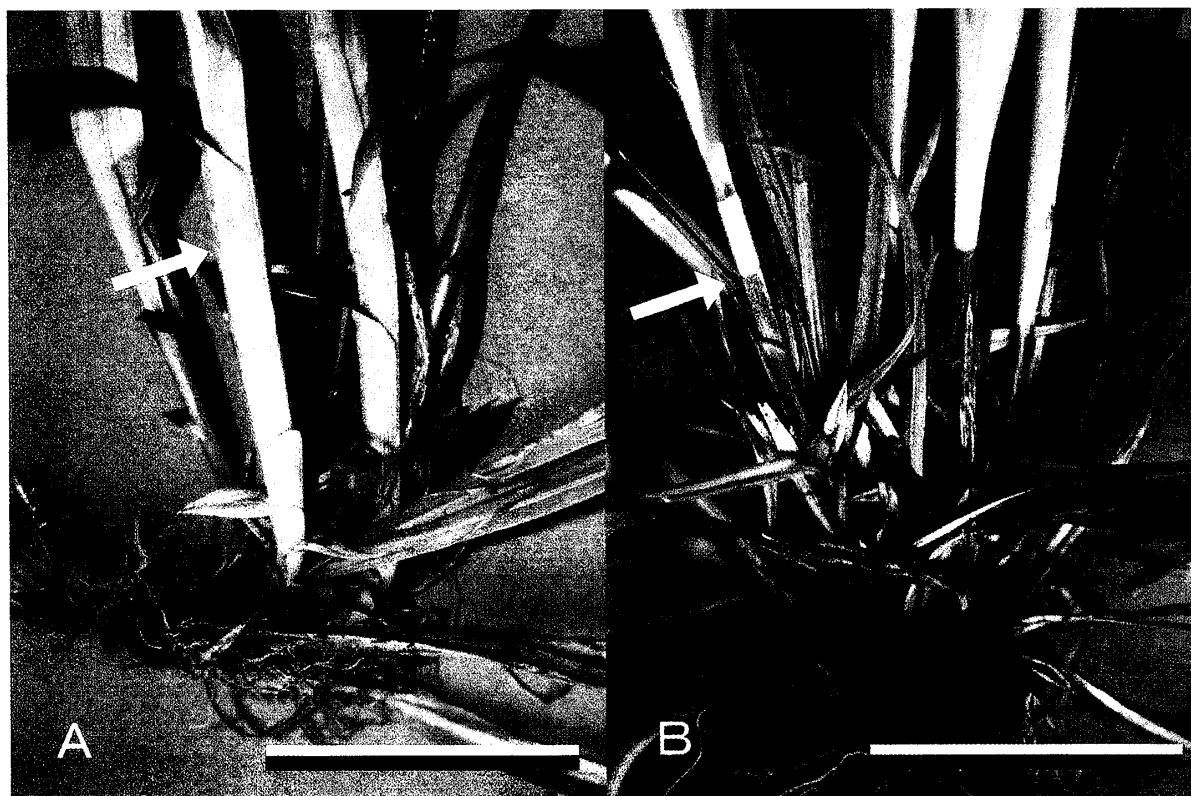


FIG. 2. Basal sheaths of *Carex foliosissima*. A: *C. foliosissima* var. *pallidivaginata*; Toyama Pref., Mt. Iburi-yama, alt. 1650m *J. Oda* 949 (KYO). B: *C. foliosissima* var. *foliosissima*; Toyama Pref., Mt. Iburi-yama alt. 900m. *J. Oda* 958 (KYO). Arrows indicate edge of basal sheath. Bar = 5cm.

Key to the varieties

Basal sheaths purplish brown to blood-reddish brown; leaf blades rather thick; perigynia with distinct veins.

.....var. *foliosissima*

Basal sheaths pale green and turning light brown when dry; leaf blades rather thin; perigynia with invisible or inconspicuous veins. var. *pallidivaginata*

var. *foliosissima*

Carex foliosissima F. Schmidt, - *Carex morrowii* Boott subsp. *foliosissima* (F. Schmidt) Ohwi, Mem. Coll. Sci. Kyoto Imper. Univ. ser. B, 6: 251 (1931). – Type: Sakhalin. Oko im südlichen Sakhalin 13 Juli 1861, *Glehn* (LE, microfiche!).

Carex morrowii Boott var. *virginica* Franch. & Sav., Enum. Pl. Jap. 2: 145 & 572 (1879). - *Carex morrowii* Boott form. *virginica* (Franch. & Sav.) Kük., Cyper. Car.: 626 (1909). – Type: Japan. In locis umbrosis: juxta Niigata, provinciae Echigo insulae Nippon, Fr. Apri. Legit

Dr. Vidal, *Savatier* 2775 (p!).

Carex morrowii Boott var. *niigatensis* Franch. & Sav., Enum. Pl. Jap. 2: 145 & 572 (1879). - *Carex morrowii* Boott form. *niigatensis* (Franch. & Sav.) Kük., Cyper. Car.: 626 (1909). - *Carex niigatensis* (Franch. & Sav.) Koidz., Fl. Symb. Orient. As.: 46 (1930). – Type: Japan. Cum varietate praecedente circa Niigata ubi detexit Vidal, *Savatier* 2773 (p!).

Carex morrowii Boott var. *longesquamata* Franch., Bull. Soc. Bot. Fr. 26: 90 (1879). – Type: Japan. Circa Niigata, *U. Faurie* 172 (p!).

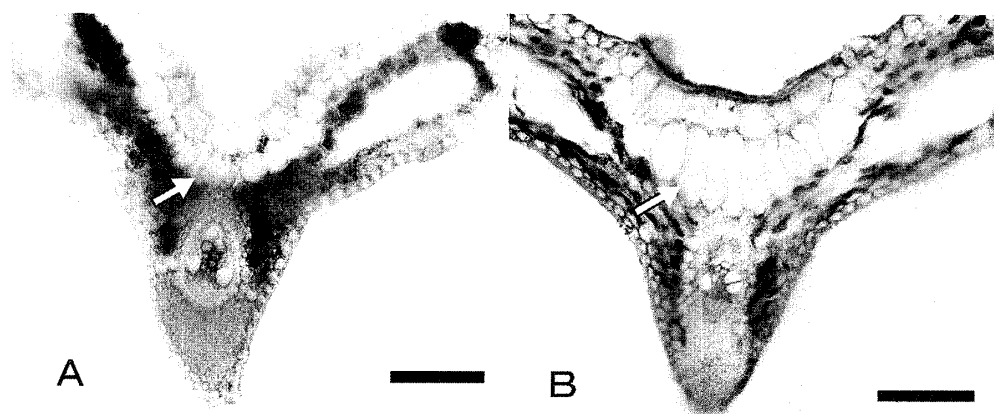


FIG. 3. Transection of leaves of *Carex foliosissima*. A: *C. foliosissima* var. *pallidivaginata*; Toyama Pref., Mt. Iburi-yama alt. 1650m, 23 Jul. 2000, J. Oda 949 (KYO). B: *C. foliosissima* var. *foliosissima*; Kyoto Pref., Hozukyo, 27 May 2000, J. Oda 837 (KYO). Arrows indicate the second layer of bulliform cells. Bar = 100 μ m.

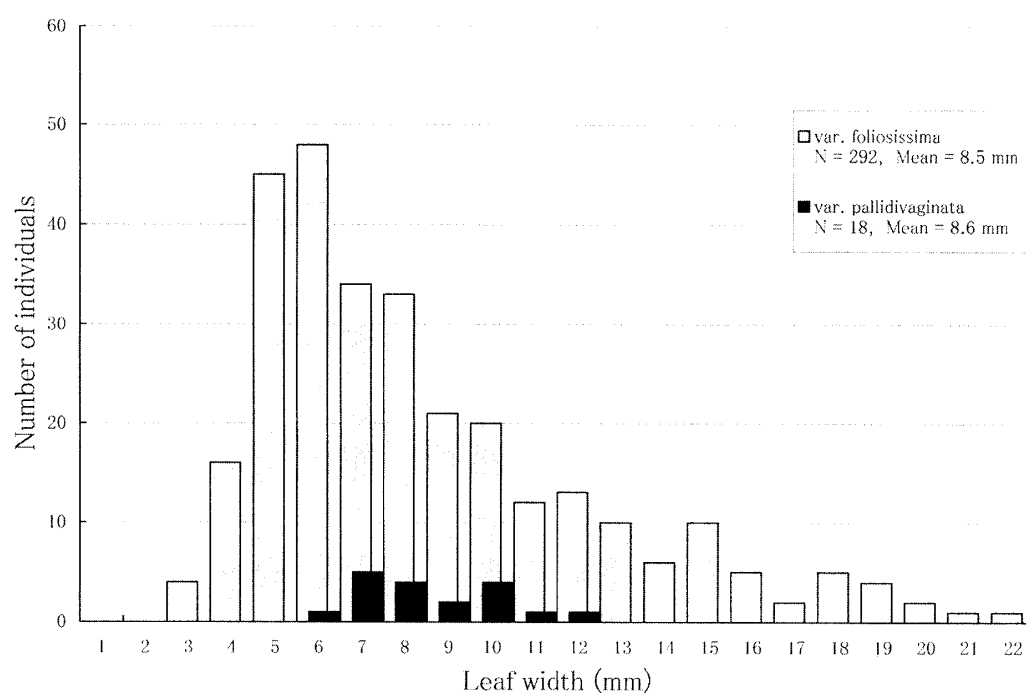


FIG. 4. Distribution and frequency of leaf width in *Carex foliosissima*.

Carex yesanensis Franch., Bull. Soc. Philom. Paris 8 sér. 7: 88 (1895, non vidi) et Nouv. Arch. Mus. Paris, 3 sér. 10: 39 (1898), pro parte. - *Carex morrowii* Boott var. *yesanensis* (Franch.) Kük., Cyper. Car.: 626 (1909). - *Carex niigatensis* (Franch. & Sav.) Koidz. var. *yesa-*

nensis (Franch. & Sav.) Koidz., Fl. Symb. Orient. As.: 46 (1930). - Type: Japan. Yéso, Forét. Au promontoire d'Yesan, *Faurie 3985* (P!, excl. a duplicate specimen of type in KYO!). (See text.)

Carex morrowii Boott var. *crassicaulis* Kük., Cyper.

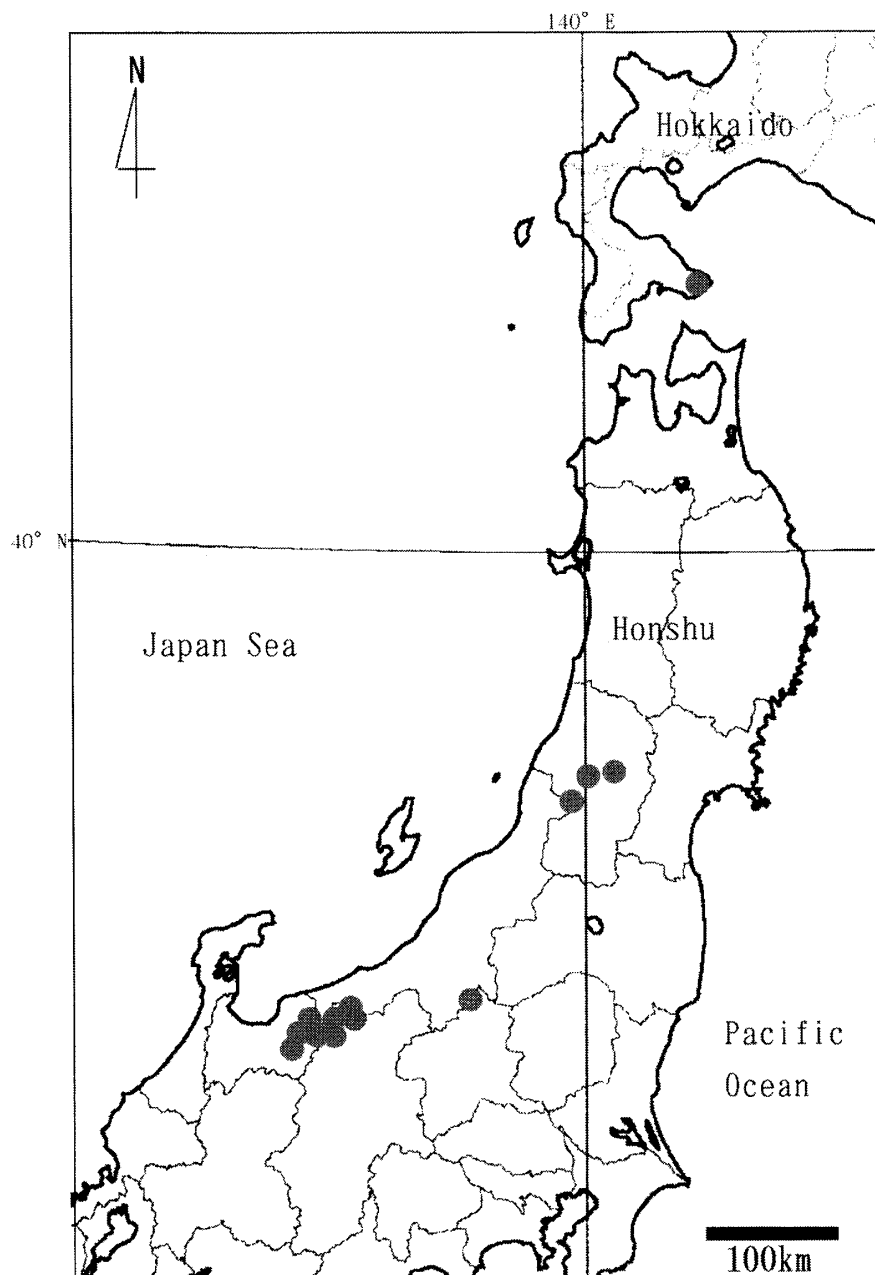


Fig. 5. Distribution map of *Carex foliosissima* var. *pallidivaginata*.

Car.: 626 (1909). - [*Carex crassicaulis* Franch., Nouv. Arch. Mus. Paris, 3 sér. 10: 40 (1898), nom. inval. (not accepted by the author)]. - *Carex niigatensis* (Franch. & Sav.) Koidz. var. *crassicaulis* (Kük.) Koidz., Fl. Symb. Orient. As.: 46 (1930). - *Carex foliosissima* F. Schmidt var. *crassicaulis* (Kük.) Akiyama, Consp. Car. Jap.: 203 (1932). - Lectotype: Japan. Cap

Soya, Faurie 7255 (*C. crassicaulis* Franch., mss.) (P!, iso- KYO!, **here designated**).

Carex niigatensis (Franch. & Sav.) Koidz. var. *brevisquama* Koidz., Fl. Symb. Orient. As.: 46 (1930). - *Carex foliosissima* F. Schmidt var. *brevisquama* (Koidz.) Akiyama, Consp. Car. Jap.: 203 (1932). - *Carex morrowii* Boott var. *brevisquama* (Koidz.) Nemoto, Fl. Japan

Suppl.: 986 (1936). – Type: Sachalin, *Faurie* 896 (KYO!, iso- P!).

Carex morrowii Boott var. *latissima* Ohwi, Mem. Coll. Kyoto Imper. Univ. ser B, 6: 251 (1931). – *Carex foliosissima* F. Schmidt var. *latissima* (Ohwi) Akiyama, Consp. Car. Jap.: 203 (1932). – Lectotype: Japan. Tottori, *Faurie* 2824 (P!, iso- KYO!, **here designated**).

Carex foliosissima F. Schmidt var. *albomediana* Akiyama, J. Fac. Sci. Hokk. Imper. Univ. ser. V, 3: 268 (1935). – Syntypes: in hortus culta. Morikawa, prov. Rikuchu, *S. Murai*, anno 1932 (SAPS!); ibidem, *Y. Fukuda*, anno 1933 (SAPS!); Shirakawa, prov. Iwaki, *T. Suzuki*, anno 1933 (SAPS!).

Culms 15-40 cm high, basal sheath purplish brown to blood-reddish brown. Leaves dark green, 2-ribbed on adaxial surface or not, 3.5-22 mm wide, rather thick; the second layer of bulliform cells thicker than the first. Staminate spike linear to clavate, 15-35 mm long, pistillate spikes 20-40 mm long. Pistillate scales light brown or partly reddish brown, 2.5-4.5 mm long. Staminate scales 7-10 mm long. Perigynia yellowish green, 2.5-3.5 mm long, with distinct veins. Achenes 1.5-2.0 mm long.

Japanese name: Oku-no-kansuge

Habitat: In forest on rather wet soil.

Distribution: Russia (Sakhalin), Japan (Hokkaido, Honshu, Shikoku, and Kyushu).

Note: Three varieties of *Carex morrowii*, var. *virginea*, var. *niigatensis*, and var. *longesquamata* were described from Niigata where the new variety *pallidivaginata* is also distributed. They were characterized by the pale staminate scales, pistillate scales twice as long as the perigynia, and pistillate scales three times longer than perigynia respectively. These characters are very variable in this species and they have not been accepted as distinct taxa (Ohwi 1936, Akiyama 1955). They all have dark purplish brown basal sheaths and perigynia with distinct veins, which are the characteristic of var.

foliosissima.

Specimens selected: **Sakhalin**. Korsakof, *U. Faurie* 896 (KYO); Aikawa, *T. Odagiri s.n.* [21 Jul. 1929] (KYO). **Hokkaido**. Kamikawa, Sorachi-gun, *G. Murata* 37451 (KYO); Abashiri, Takigami-cho, Monbetsu, *G. Murata & T. Yahara* 38012 (KYO). **Honshu**. Aomori Pref.: Kazamamura, Shimokita-gun, *K. Mimoro et S. Tsugaru* 3733 (KYO). –Iwate Pref.: Mt. Yakeishi-dake, *H. Iwabuchi* 4528 (KYO). –Akita Pref.: Kamitakara-yama, Ogatsumachi, *Y. Horii* 585 (KYO). –Miyagi Pref.: Mt. Daitodake, Sendai-shi, *H. Ohashi & T. Kaneko s.n.* [3 May 1960] (TUS); Mt. Suzugamori, Kurihara-gun, *H. Ohashi et al. s.n.* (TUS). –Fukushima Pref.: Kotani-gawa, Aidzuwakamatsu-shi, *S. Saito* 54092 (TUS). –Niigata Pref.: Shimoda-mura, Minamikanbara-gun, *G. Murata* 45101 (KYO); Mt. Yahiko-san, Nishikanbara-gun, *J. Oda* 873 (KYO). –Ishikawa Pref.: Saikawa dam to Mt. Takasaburo-yama, Kagashi, *S. Tsugaru et al.* 12654 (KYO); Mt. Kuraga-take, Tsurugi-machi, Ishikawa-gun, *S. Tsugaru* 7944 (KYO). –Toyama Pref.: Taira-mura, Higashitonami-gun, *G. Murata* 67370 (KYO). –Fukui Pref.: Obara, Katsuyama-shi, *S. Watanabe* 134 (KYO). –Aichi Pref.: Nagura-mura, Mikawa, *K. Torii s.n.* [2 Jun. 1957] (KYO). –Nagano Pref.: Kaida-mura, Kiso-gun, *M. Mizushima* 12683 (KYO); Tateshina-mura, Kitasaku-gun, *T. Ohmura* 18373 (KYO). –Gifu Pref.: Kamitakara-mura, Yoshiki-gun, *H. Nagase* 90678 (KYO); Tokuyama-mura, Ibi-gun, *H. Takahashi* 10679 (KYO). –Shiga Pref.: Mt. Ryozen, Sakata-gun, *N. Fukuoka* 4704 (KYO); Imazducho, Takashima-gun, *H. Koyama* 8015 (KYO). –Kyoto Pref.: Hozdu-kyo, Kyoto-shi, *J. Oda* 837 (KYO); Hanase-Haraji-cho, Kyoto-shi, *G. Murata* 26236 (KYO); Ashiu, Miyama-cho, Kitakuwada-gun, *K. Ueda et al.* 507 (KYO). –Osaka Pref.: Mt. Makio-san, Izdumi-shi, *M. Kuwashima* 37869 (OSA). –Nara Pref.: Mt. Wasamata-yama, Yoshinogun, *S. Tsugaru et al.* 7913 (KYO); Mt. Gyojyagaeri-dake, Yoshinogun, *M. Hotta & N. Fujita* 41 (KYO). –Hyogo Pref.: Mt. Hyonosen, Yabu-gun, *T. Shimizu* 80135 (KYO); Izushi-cho, Izushi-gun, *N. Fukuoka* 12489 (KYO). –Okayama Pref.: Kanba, Katsuyama-cho, Maniwa-gun, *N. Fukuoka* 10188 (KYO). –Hiroshima Pref.: Yoshiwa-mura, Saiki-gun, *T. Fujii T-0599* (KYO). –Tottori Pref.: Mt. Daisen, Saihaku-gun, *A. Tanaka* 23882 (KYO). –Shimane Pref.: Mt. Daimanji-san, Oki-gun, *N. Kurosaki* 9987 (KYO). –Yamaguchi Pref.: Mikawa-cho, Kuga-gun, *K. Oka* 19794 (KYO). **Shikoku**. Ehime Pref.: Bessiyamamura, Uma-gun, *O. Tokui* 4153 (KYO). **Kyushu**. Fukuoka Pref.: Mt. Seburi-yama, Fukuoka-shi, *S. Tsutsui* 15578

(KYO); Kawachi-keikoku, Fukuoka-shi, *S. Tsutsui* 13628 (KYO). —Oita Pref.: Yamakei-cho, Shimoge-gun, *Tak. Shimizu* 86157 (KYO).

var. **pallidivaginata** J. Oda & Nagam., var. nov. — Fig. 1, 2A, 3A & 5.

Carex yesanensis Franch., Bull. Soc. Philom. Paris 8 sér. 7: 88 (1895, non vidi) et Nouv. Arch. Mus. Paris, 3 sér. 10: 39 (1898), pro parte, excl. typ.

A typo vaginis basilaribus pallidis vel in sicco fulvo-suffusis, foliis tenuibus laete viridibus, nervis utriculorum non visilibus vel inconspicuis differt.

Type: Japan, Toyama Pref., Mt. Iburiyama, Asahi-machi, Shimoniikawa-gun, 23 July 2000, *J. Oda* 949 (holo- KYO, iso- KPM, OKAY, OSA, TNS, TUS)

Culms 15–30 cm high, basal sheaths pale green, and turning light brown when dry. Leaves light green, 6–12 mm wide, 2-ribbed on adaxial surface, rather thin; the second layer of bulliform cells as thick as the first layer. Staminate spike clavate, 15–25 mm long, pistillate spikes 20–30 mm long. Pistillate scales pale green or light brown, 3–3.5 mm long. Staminate scales light brown, 7.5–9 mm long. Perigynia pale yellowish green, 2.5–3 mm long, veins invisible or inconspicuous. Achenes 1.5–1.8 mm long.

Japanese name: Usuiro-okunokansuge

Habitat: In upper beech forest and subalpine zones.

Distribution: Japan, endemic. Hokkaido (Cape Esan) and the Japan Sea side of Honshu (Yamagata, Niigata, Toyama and Nagano).

Other specimens examined: **Hokkaido**. Cape Esan, *U. Faurie* 3985 (KYO, not identical with the holotype of *Carex yesanensis* in p). **Honshu**. Yamagata Pref.: Mt. Gassan, *Y. Yuki* s.n. [Aug. 1932] (KYO), 14263 (YMG); Mt. Hayama, 1050 m alt., *K. Kato* s.n. [15 Jun. 1972] (YMG); Mt. Ito-dake, Higashitagawa-gun, *Murakami* s.n. [28 Jul. 1962] (KANA). —Niigata Pref.: Mt. Makiyama, Shiozawa-cho, Minamiuonuma-gun, 1560 m alt., *H. Kariya* 4551 (KYO), 1830 m alt., *H. Kariya* 5515 (KYO);

Mt. Okenashi-yama, Arai-shi, *J. Yoshikawa* 3917 (TUS); Mt. Korengesan, Itoigawa-shi, *S. Iwano* 7015 (TUS); en route from Udo-gawa to Mt. Renge-yama, Itoigawa-shi, *S. Takahashi* s.n. [1 Aug. 1959] (TUS). —Toyama Pref.: west side of Mt. Hakuba, *J. Ohwi* 7805 (KYO); Mt. Tateyama, Murodo to Kobo, *Z. Tashiro* s.n. [30 Aug. 1929] (KYO); Tateyama-onsen, *Z. Tashiro* s.n. [31 Aug. 1929] (KYO); Hayatsuki-one, west side of Mt. Tsurugi-dake, 2200 m alt. *M. Ichikawa* s.n. [30 July 2000] (KYO); en route from Dainichi-daira to Mt. Dainichi-dake, *M. Mikage* 5581 (OSA). —Nagano Pref.: Mt. Amakazari-yama, Otari-mura, Kitaazumi-gun, 1800–1900 m alt., *K. Seto* 25748 (OSA); Hakuba-tsugaike, Otari-mura, Kitaazumi-gun, *J. Ohwi* 7707 (KYO); Hakuba-tengu, Otari-mura, Kitaazumi-gun, *Y. Okamura* 1138 (TUS); Hakuba-sanroku, *T. Kodama* s.n. [Aug. 1949] (OSA).

In this study numerous specimens in the herbaria, KANA, KYO, OSA, P, SAPS, TUS, and YMG were examined. Our cordial thanks are due to directors, curators, and collectors of these herbaria. We thank Mr. Masato Ichikawa, Mie Pref., Mr. Hisashi Kariya, Niigata Pref., and Mr. Osamu Tokui, Ehime Pref. who donated valuable specimens for this study. We also thank Dr. Sachiko Nishida, Nagoya University, who advised us on leaf anatomy.

References

- Akiyama, S. 1932. Conspectus Caricum Japonicarum. J. Fac. Sci. Hokkaido Imper. Univ. Ser V, 2(1): 1–266.
- . 1933a. On Systematic Anatomy of the leaves of some Japanese Carices (I). Bot. Mag. Tokyo 47: 446–461. (in Japanese).
- . 1933b. On Systematic Anatomy of the leaves of some Japanese Carices (II). Bot. Mag. Tokyo 47: 532–550. (in Japanese).
- . 1933c. On Systematic Anatomy of the leaves of some Japanese Carices (III). Bot. Mag. Tokyo 47: 767–797. (in Japanese).
- . 1933d. On Systematic Anatomy of the leaves of some Japanese Carices (IV). Bot. Mag. Tokyo 47: 863–881. (in Japanese).
- . 1955. Carices of the Far Eastern Region of Asia. Hokkaido Univ., Sapporo. (in Japanese).
- Egorova, T.V. 1999. A. L. Takhtajan (ed.). The Sedges (*Carex* L.) of Russia and adjacent States. St. Peter. Chem. Acad., St. Petersburg.
- Holmgren, P. K., N. H. Holmgren & L. C. Barnett (eds.). 1990. Index herbariorum, part I: The herbaria of the

- World (8th ed.), New York Botanical Garden, New York.
- Koidzumi, G. 1930. *Florae Symbolae Orientali-Asiaticae*. Kyoto.
- Koyama, T. 1961. Concerning the variants of the *Carex sachalinensis* group. *Bot. Mag. Tokyo* 74: 321-330.
- . 1962. Classification of the Family Cyperaceae (2). *J. Fac. Sci. Univ. Tokyo sect. III, Bot.* 8: 150-278.
- . 1964. Cyperaceae. *Color. Illus. Herb. Pl. Jap.* (Monocot.). Hoikusha, Osaka: 210-301. (in Japanese).
- Okamoto, K. 1965. Taxonomic study of the Carices in the Western Honshu of Japan. *Bull. Okayama Coll. Sci.* 1: 1-105
- Ohwi, J. 1953. *Flora of Japan*. Shibundo, Tokyo (in Japanese).
- & M. Kitagawa. 1992. *New Flora of Japan, Revised*. Shibundo, Tokyo. (in Japanese).

Received September 6, 2002, accepted March 29, 2003